CONTENT

WELCOME

It is a pleasure for us to welcome all of you to the SFB 940 Summer School 2017 »Approaches to volition«. During the next two days, we will convene here at the NH Hotel in the centre of Dresden to discuss a wide variety of approaches to the volitional control of emotions, motivation and action as well as the means to study them.

Six symposia will be held focusing on philosophical, circuit-based, decision-making, clinical, computational, and cognitive approaches to volition. International experts will present the latest developments in their fields and thus provide a common background for the attending PhD students upon which they can develop and advance their own studies and projects.

Furthermore, PhD students will present posters of their own research projects and will have the opportunity to discuss their work within an international and interdisciplinary context. In addition, this Summer School features the special issue *Science Biographies* which aims to stimulate reflection and discussion about careers in science as well as to provide advice and help.

Thus, we are very pleased that we could bring together researchers from diverse fields in the study of volition and would like to thank the invited speakers and the organizers of the workshops who came here to share their knowledge, expertise, and experiences with the students of our PhD program. We would like to extend our thanks the PhD students themselves who will present and discuss their own research.

We hope you find the Summer School both interesting and stimulating and that this meeting will foster further achievement. We are looking forward to your feedback and wish all of you an inspiring and pleasant time!

| Thomas Goschke | Alexander Strobel | Clemens Kirschbaum |
| CRC Speaker/MGK Represent | Chief MGK Coordinator | Deputy MGK Coordinator |

LOCATIONS & MAP

Pre-conference Workshops (Tuesday 20 June 2017)

Workshop 1 (fMRI Analysis Methods):   TUD, BZW, Room A 442

Workshop 2 (Scientific Publishing):   TUD, ASB, Room 206 a-c
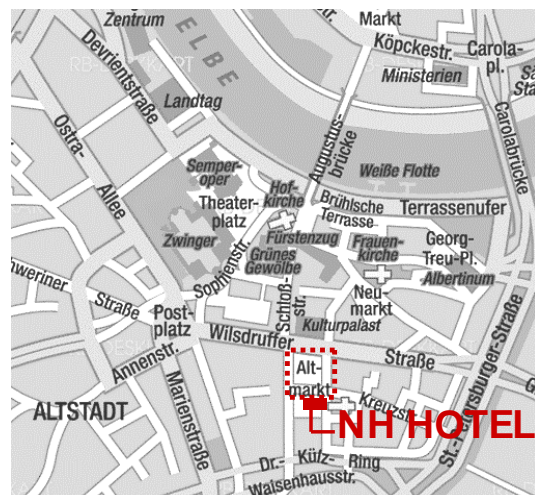
Pre-conference Workshops (Wednesday 21 June 2017)

Workshop 3 (Neuroanatomy):   University Hospital C.G. Carus, TUD,
Medizinisch-Theoretisches Zentrum (MTZ),
Fiedlerstr. 42, lecture hall 2

Summer School (Thursday 22 June and Friday 23 June 2017)

NH Hotel Dresden Altmarkt, An der Kreuzkirche 2, 01067 Dresden

Symposia: Room "Semper I-III"
Poster sessions: Room "August der Starke"

Social Evening: NH Hotel Dresden Altmarkt

PROGRAM AND TIME TABLE

Tuesday 20 June 2017

Workshop 1:   fMRI Analysis Methods
                     Holger Mohr, Hannes Ruge (TU Dresden, Germany)

Workshop 2:   Scientific Writing and Publishing
                     Michael Smolka, Christian Beste, Ralph Müller-Pfefferkorn
                     (TU Dresden, Germany)

Wednesday 21 June 2017

Workshop 3:   Neuroanatomy Lab Course
                     József Jászai (University Hospital C.G. Carus, TU Dresden, Germany)

Thursday 22 June 2017

Symposium 1:   Philosophical Approaches
                     Thomas Goschke (TU Dresden, Germany)

Symposium 2:   Circuit-Based Approaches
                     David Badre (Brown University, USA)

Poster Session I

Symposium 3:   Decision-Making Approaches
                     Amitai Shenhav (Brown University, USA)

Special Issue: Science Biographies

Friday 23 June 2017

Symposium 4:   Clinical Approaches
                     Tanja Endrass (TU Dresden, Germany)

Symposium 5:   Computational Approaches
                     Stefan Kiebel (TU Dresden, Germany)

Poster Session II

Symposium 6:   Cognitive Approaches
                     Bernhard Hommel (Leiden University, The Netherlands)

PROGRAM AND TIME TABLE

	Tue 20 June	Wed 21 June	Thu 22 June	Fri 23 June
09:00	Workshop 1: fMRI Analysis Methods		Symposium 1 **Philosophical Approaches**	Symposium 4 **Clinical Approaches**
10:00	Workshop 1: fMRI Analysis Methods		Break	Break
11:00	Workshop 1: fMRI Analysis Methods	Workshop 3: Neuroanatomy	Symposium 2 **Circuit-based Approaches**	Symposium 5 **Computational Approaches**
12:00	Workshop 1: fMRI Analysis Methods	Workshop 3: Neuroanatomy	Lunch	Lunch
13:00	Workshop 1: fMRI Analysis Methods / Workshop 2: Publishing	Workshop 3: Neuroanatomy	Poster Session I	Poster Session II
14:00	Workshop 2: Publishing	Workshop 3: Neuroanatomy	Break	Break
15:00	Workshop 2: Publishing	Workshop 3: Neuroanatomy	Symposium 3 **Decision-making Approaches**	Symposium 6 **Cognitive Approaches**
16:00	Workshop 2: Publishing	Workshop 3: Neuroanatomy	Break	
17:00			**Science Biographies**	Refreshments / Farewell
18:00			**Science Biographies**	Refreshments / Farewell
19:00			Social Evening	

WORKSHOP 1: fMRI ANALYSIS METHODS (Tuesday 09:00-16:00)

fMRI ANALYSIS METHODS

Holger Mohr & Hannes Ruge

Technische Universität Dresden

Over the last 25 years, functional magnetic resonance imaging (fMRI) has evolved into one of the main modalities for in-vivo imaging of the human brain. Reflecting the complexity of brain, fMRI datasets come with a complex and high-dimensional spatio-temporal structure. A large set of methods is available to explore and model these data. This workshop will give an introduction to the most frequently used approaches for activation and connectivity analysis of fMRI data. In the first part, the general linear model (GLM) will be introduced, which is the most important approach to model task-evoked brain activity. The GLM can be flexibly used for different experimental design types and may also serve as a basis for subsequent extended analyses. Due to the great flexibility of the GLM, many options are available in terms of how the actual experimental design is transformed into the design matrix of the GLM. These choices may have a large impact on the results. In the second part, various forms of multivariate pattern analysis (MVPA) and connectivity analysis will be introduced, covering both basic principles and possible pitfalls and drawbacks of the methods. Specifically, feature construction along the spatial and temporal domains and technical topics such as cross-validation and parameter selection for MVPA will be discussed. Connectivity analysis will cover both functional connectivity (PPI, beta series) and effective connectivity (DCM). In the third part, practical questions of the participants will be discussed.

Course venue: Technische Universität Dresden, BZW, Room A442

SCIENTIFIC WRITING AND PUBLISHING

Michael Smolka, Christian Beste & Ralph Müller-Pfefferkorn

Technische Universität Dresden

The workshop will focus on useful strategies for writing and preparing a manuscript for submission. A second aim will be the discussion and practice of policies on how to handle revisions. Furthermore, participants will discuss individual questions regarding the subjects of publication, submission, revision as well as formalities and regulations of the publication process.

Course venue: Technische Universität Dresden, ASB 206 a-c

WORKSHOP 3: NEUROANATOMY (Wednesday 11:00-17:00)

NEUROANATOMY LAB COURSE

József Jászai

Institute for Anatomy, Faculty of Medicine C.G. Carus, Technische Universität Dresden

Understanding macroscopic structure of the *central nervous system* (CNS) is the basis for learning pathways, functional circuits subserving higher cognitive function. Therefore, the study of external and internal morphology of the CNS in a wet lab (i.e. dissection-room) significantly facilitates learning of functional systems (in lecture courses or in computer labs) that makes up the most significant portion of many neuroanatomical courses. Without previous visual experience, it is an extremely difficult task to overcome.

The neuroanatomy course provides a broad overview of the structure of the CNS dealing with representative levels of the neuraxis, with a principal focus on issues relevant to further understanding of functional aspects the nervous system. The main objectives of the course are to (1) provide the students with a basic working knowledge and nomenclature of the central nervous system and (2) to present the basic functional neuroanatomy required to understand the functional systems. These objectives are achieved by use of fixed specimens of whole brains in a step-by-step dissection procedure and brain sections to provide a general overview of the 3-D structure of the brain.

Course venue: University Hospital C.G. Carus, Medizinisch-Theoretisches Zentrum (MTZ), lecture hall 2, Fiedlerstraße 42

FROM "FREE WILL" TO META-CONTROL: PHILOSOPHICAL AND EMPIRICAL CHALLENGES IN RESEARCH ON VOLITION AND COGNITIVE CONTROL

Thomas Goschke

Chair of General Psychology, Technische Universität Dresden, Germany

Volition is often equated with the idea of a "free will", that is considered essential for our self-conceptualization as intentional agents who can be held morally responsible for their actions. However, it has been argued that (i) free will is incompatible with the scientific quest for causal mechanisms underlying our decisions and actions; (ii) that the subjective impression of volitional control is an illusion because conscious intentions are not the real causes of behavior; and (iii) that the concept of volitional control is merely a placeholder for unexplained mechanisms (i.e., a homunculus that should be banished from theories of human behavior).

In this lecture, I will first give a condensed overview of the philosophical problem of free will. I will reject the idea of an undetermined free will and argue for a naturalistic concept of volition, according to which volition emerges from a set of specific cognitive control mechanisms. Second, I will address the question whether and in what sense conscious intentions play a causal role in the control willed actions. Third, I will argue that despite impressive progress in mechanistic accounts of volitional control, we still face a homunculus challenge, as it remains an unresolved question how cognitive control is itself "controlled". While the evolution of cognitive control capacities dramatically enhanced cognitive flexibility, it also gave rise to novel control dilemmas and meta-control problems (e.g., how to dynamically adjust the balance between stable goal shielding and flexible goal switching (stability-flexibility-dilemma), between goal-directed focusing of attention and stimulus-driven background-monitoring (selection-monitoring dilemma), or between exploitation and exploration (exploitation-exploration dilemma)). Rather than the metaphysical problem of free will, a central challenge for volition science is to explain in mechanistic terms how meta-control parameters and complementary control modes are adapted to changing task demands, modulated by internal states, and moderated by individual differences.

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PREFRONTAL CORTEX AND THE HIERARCHICAL CONTROL OF BEHAVIOR

David Badre

Department of Cognitive, Linguistic & Psychological Sciences, Brown University, Providence, USA

This talk will describe a recent line of research in our lab investigating the cognitive and neural systems that support hierarchical cognitive control, or our ability to simultaneously control immediate actions while also holding more abstract, temporally remote goals in mind. Psychologists have long proposed that we have a capacity for hierarchical control, citing its potential contributions to sequential behavior, as well as higher-order planning, reasoning, and abstraction. Despite its importance for cognition, the cognitive and neural mechanisms that support hierarchical control remain unknown. Here I will provide a line of evidence suggesting that this type of complex control could arise through elaboration of the simple cortico-striatal motor circuit.

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THE COSTS OF CHOICE AND THE VALUE OF CONTROL

Amitai Shenhav

Department of Cognitive, Linguistic & Psychological Sciences, Brown University, Providence, USA

Prior research has demonstrated that, for all its benefits, volition comes at a cost. For instance, while people generally prefer to have free choice over their actions, they often find such choices costly (and, for some people, even impairing), particularly when those choices involve selecting between multiple conflicting options. I will present a set of neuro-imaging studies that explore the aversive experiences people have when making such decisions, even (and, in fact, especially) when any of their choices would lead to a very good outcome.

These studies examine the factors that lead people to experience these forms of choice anxiety, and those that lead them to disregard such experiences and want more good options (and perhaps the free will to choose amongst them) anyway. A second cost of volition is that it requires us to constantly make decisions about whether, when, and how to apply volitional control over more automatic processes. I will describe a theoretical framework that we have developed for how such choices can be made based on the overall Expected Value of Control. I will show that a computational model based on this framework can account for a variety of control adjustments that have been previously observed, and will further describe recent empirical work that seeks to validate behavioral predictions of this account.

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PERFORMANCE MONITORING AND LEARNING IN OBSESSIVE-COMPULSIVE DISORDER

Tanja Endrass

Chair of Addiction Research, Technische Universität Dresden, Germany

Obsessive-compulsive disorder is characterized by repeatedly occurring obsessive thoughts and compulsive behaviors. These behaviors are executed with the goal to prevent potential negative events or to counteract or neutralize mental acts. Although the initiation of compulsive behaviors is often motivated by a specific event, compulsions are typically excessive in relation to the intended goal (e.g. washing the hands 20 times to get clean the hands). These observations suggest that OCD patients may suffer from deficits in volitional control of their actions.

In my talk, I will address two aspects of action control: (1) performance monitoring as the process of monitoring ongoing behavior in order to detect and prevent errors and (2) behavioral flexibility and learning. While enhanced error-related brain activity suggests overactive performance monitoring, which should be related to improved adjustment behavior, the opposite was observed in OCD. Patients show reduced behavioral flexibility and perseveration as indices of reduced goal-directed control as it is observed in addictive disorders. Finally, I will discuss these findings in the context of trans-diagnostic phenotypes.

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COMPUTATIONAL MODELS OF COGNITIVE CONTROL

Stefan Kiebel

Chair of Neuroimaging, Technische Universität Dresden, Germany

One core purpose of cognitive control is to pursue goals over time. Cognitive control is especially relevant under adverse conditions, for example when there is uncertainty about the current state of the environment or about the consequences of one's own actions. Recent experimental and computational modelling work has started to address questions about cognitive control under uncertainty using novel tasks. In these tasks subjects need to make a sequence of decisions to reach a specific goal in a dynamic task environment.

In my talk, I will review key publications in this emerging field and will discuss the potential benefits of these novel paradigms, in particular for addressing questions about meta-control parameters and their dynamics. I conclude that such questions can be best addressed in goal-reaching task designs when combined with computational modelling approaches like reinforcement learning or active inference.

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THE YIN AND YANG OF COGNITIVE CONTROL

Bernhard Hommel

Cognitive Psychology Unit and Leiden Institute for Brain and Cognition, Leiden University, The Netherlands

Humans often face cognitive-control dilemmas that are binary in nature, with the choice between persistence/exploitation and flexibility/exploration being a crucial one. Tackling these dilemmas requires meta-control, i.e., the control of the current cognitive-control policy. This contribution reviews evidence suggesting that meta-control states can be communicated and passed on to others through instruction and cultural learning. A key example for instruction-based sharing is meditation, which can be seen as a systematized procedure to induce particular meta-control states in the meditator.

A key example for learning-based sharing is religion or religious practice, which can be seen (among other things) as a systematized cultural framework to induce particular default meta-control states in the believer. Indeed, there is systematic evidence that instructing novices to engage in focused-attention or open-monitoring meditation results in systematic biases of meta-control towards persistence (as with focused-attention meditation) or towards flexibility (as with open-monitoring meditation), as evident from tasks tapping attentional selection, conflict monitoring, and convergent or divergent thinking. Along the same lines, members of religions emphasizing individual responsibility versus collectivism show systematic biases towards persistence or flexibility, respectively, as assessed in cognitive tasks tapping the distribution of attentional resources, the processing of response conflict, and patience. This contribution provides a theoretical integration of available findings and a mechanistic account explaining how instruction- and learning-based transfer methods work and how they establish particular meta-control states in others.
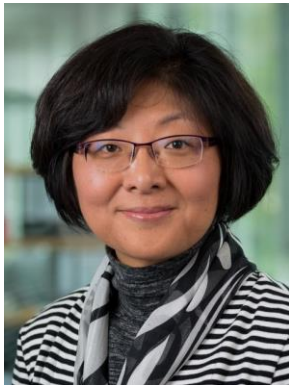
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SCIENCE CAREERS

Katja Beesdo-Baum, Shu-Chen Li, Stefan Kiebel & Alexander Strobel

Technische Universität Dresden, Germany

PhD students have chosen to work in science at least for some years. A substantial number of postgraduates are intent on a career in academia.

Which opportunities and obstacles await scientists in their academic career? Does the topic of a PhD student's dissertation influence their career path? Does the choice of supervisor? How can one organize help and support? Are there foreseeable longer-lasting difficulties ahead? What about the work-life-balance? Is an academic career projectable at all?

During the *Science Biographies* session four scientists will talk about the course of their individual careers. After their talks they will answer questions and discuss career related issues with the PhD students.

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POSTER SESSION I (Thursday 13:30-14:30)

(1) Bensmann, Wiebke

The interaction of subliminal and consciously induced cognitive conflicts - a graph theoretical approach (B8)

(2) Chen, Hsiang-Yu

Exploring adult development of complementary control processes during spatial learning and decision

(3) Fröhner, Juliane Hilde

Temporal discounting trajectories and their impact on adolescent substance use (B8)

(4) Grage, Tobias

A shift in the balance: The interaction dynamics of meta-control parameters and situational demands in color set shifting (A8)

(5) Huber, Felicitas

Striatal structural alterations related to compulsive Internet use but not time spent on social networks – preliminary results (C5)

(6) Jargow, Janine

Effects of TMS over the angular gyrus during a Simon task (A2)

(7) Kruse, Johanna

Eating junk food versus staying healthy: Temporal dynamics of self-control in everyday conflict situations (A6)

THE INTERACTION OF SUBLIMINAL AND CONSCIOUSLY INDUCED COGNITIVE CONFLICTS - A GRAPH THEORETICAL APPROACH

Wiebke Bensmann[1], Nicolas Zink[1], Moritz Mückschel[1], Christian Beste[1,2] & Ann-Kathrin Stock[1]

[1] Department of Child and Adolescent Psychiatry, Faculty of Medicine, TU Dresden, Germany
[2] Experimental Neurobiology, National Institute of Mental Health, Klecany, Czech Republic

Controlled behavior can be influenced by subliminal or consciously processed information conflicts. Yet, there is evidence that these two types of conflict interact in their modulation of controlled behavior. However, the underlying neural mechanisms have remained largely unclear. In this study, we investigate whether there are differences in neurophysiological mechanisms and networks underlying such modulations using event-related potentials (ERPs), time-frequency analyses as well as small world analyses.

A group of n= 40 young and healthy participants perform a paradigm, which combines a target stimulus with a subliminal prime as well as with consciously perceived flankers. The results show the interaction of subliminal and consciously processed conflicts occurring at earliest stage of perceptual and attentional processing (P1) and response selected stage (N2). Also, results show that the interaction of these two conflicts is associated with stronger theta band activity at the electrode Cz. However, "small world" properties, which are thought to reflect efficient network organization, do not show the interaction of these two types of conflict. These results suggest that the interaction of subliminal and consciously triggered conflicts reflect a local process either than an efficient network organization.

EXPLORING ADULT DEVELOPMENT OF COMPLEMENTARY CONTROL PROCESSES DURING SPATIAL LEARNING AND DECISION

Hsiang-Yu Chen[1], Christian Bäuchl[1], Manousos Klados[1], Franka Thurm[1], Michael Smolka[2] & Shu-Chen Li[1]

[1] Chair of Lifespan Developmental Neuroscience, TU Dresden, Germany

[2] Department of Psychiatry and Psychotherapy, Section of Systems Neuroscience, Faculty of Medicine Carl Gustav Carus, TU Dresden, Germany

Previous research has revealed two modes in spatial learning: representing the spatial models (layouts) of a space which is implemented by hippocampus, and associating environmental cues with locations that is sub-served by striatum. Relatedly, studies of spatial decision-making have demonstrated that forward planning strategy involves forming spatial representations of reward contingencies in the environment that recruited hippocampus and frontal regions, whereas reinforcement-based learning strategy utilizes action-reward contingencies and is striatum-depended.

Evidence from the two-stage decision studies indicates that dopaminergic modulation regulates the trade-offs between model-based, goal-directed and habitual, reward-driven controls. Although ample evidence points to age-related decreases in dopaminergic functioning, research on age-related changes in complementary control processes in spatial learning and decision is still sparse. In this study, we will employ a spatial memory task and a spatial decision task to investigate age-altered prioritization in hippocampus- and striatum-dependent control processes. Preliminary results from pilot studies showed that younger adults engage the hippocampus during spatial learning and rely on memories of spatial layouts during spatial decision-making. Older adults, however, relied more on striatal-dependent cue-location associations during spatial learning, and updated values of actions locally after rewards were encountered during spatial decision-making. These findings suggest age-altered spatial representations in hippocampal-striatal circuitry.

TEMPORAL DISCOUNTING TRAJECTORIES AND THEIR IMPACT ON ADOLESCENT SUBSTANCE USE

Juliane H. Fröhner[1], Nils B. Kroemer[1,2], Shakoor Pooseh[1] & Michael N. Smolka[1]

[1] Department of Psychiatry and Psychotherapy, Section of Systems Neuroscience, Faculty of Medicine Carl Gustav Carus, TU Dresden, Germany

[2] Department of General Psychiatry and Psychotherapy, University of Tübingen, Germany

Due to the proceeding brain maturation, adolescents are characterized by impulsive behavior and vulnerable to the development of substance use disorders. Here, we focus on the use of alcohol and tobacco and the association with impulsivity measured with an intertemporal choice task (ITECH). We investigated adolescents at ages 14, 16, and 18 during functional magnetic resonance of an ITECH task to describe longitudinal discounting trajectories.

Furthermore, we examined whether the discounting rate predicts substance use and if so, whether there are associated differences in value tracking in the brain. Noteworthy, our participants show relatively low and non-pathological substance use. Hierarchical linear modelling enabled us to differentiate between time-dependent variables such as discounting rate and time-independent variables such as gender. Discounting rate was stable for male subjects, but it decreased for females. Regarding substance use, higher discounting was associated with increased smoking and not with drinking. However, smoking did not correlate with value-related brain responses. Concluding, we assume differing underlying mechanisms for smoking and drinking in adolescents. We could not yet identify an association between value-related brain responses and smoking, presumably because the reliability of the value-tracking signal within subjects was surprisingly low.

A SHIFT IN THE BALANCE: THE INTERACTION DYNAMICS OF META-CONTROL PARAMETERS AND SITUATIONAL DEMANDS IN COLOR SET SHIFTING

Tobias Grage, Simon Frisch & Stefan Scherbaum

Chair of Methods of Psychology and Computational Modeling, Technische Universität Dresden, Germany

In goal directed behavior, two opposed constraints have to be satisfied: on the one hand, one has to be able to pursue a goal against obstacles and distractions, thereby avoiding volatility; on the other hand, one has to let loose when alternatives become more attractive or the goal becomes unattainable, thereby avoiding futile perseveration. These opposing constraints have been conceptualized as the control dilemma between the shielding of goals from distraction and the shifting of goals when necessary.

It is assumed that the balance between perseverative and volatile behavior is regulated by meta-control parameters which configure the cognitive system's default mode of processing. To investigate these meta-control parameters, we shifted this balance by manipulating situational demands (e.g. proportion congruency) within a color-based shifting paradigm. We examine the temporal dynamics of how congruency effects and shift-costs are affected by situational demands via mouse tracking. Furthermore, we use a dynamic neural field based model in order to identify neural parameters which convey the shift in balance.

STRIATAL STRUCTURAL ALTERATIONS RELATED TO COMPULSIVE INTERNET USE BUT NOT TIME SPENT ON SOCIAL NETWORKS – PRELIMINARY RESULTS

Felicitas Huber, Kevin Hilbert, Catharina Voß, Lars Pieper, John Venz, Charlotte Frech, Jürgen Hoyer & Katja Beesdo-Baum

Chair of Behavioral Epidemiology, Technische Universität Dresden, Dresden, Germany

Discussion persists on whether problematic Internet use constitutes a behavioral addiction and has comparable neural correlates. Neuroimaging findings suggest similarities of neural mechanisms between Internet and substance abuse, e.g. in fronto-striatal circuits. Here we present preliminary results of an investigation on compulsive Internet use and time spent on social networks. Participants were N = 102 adults from the epidemiological Behavior and Mind Health study, aged 18 to 22, who volunteered for MRI examination.

Whole-brain grey matter data were analyzed with voxel-based morphometry. Multiple regression analyses were conducted on compulsive Internet use and time spent on social networks, separately and in combination (clusterwise pFWE < 0.05). Compulsive Internet use was positively associated with increased grey matter volumes (GMV) in a cluster covering the right putamen and pallidum. Time spent in social networks was unassociated with GMV. Results remained when including both compulsive Internet use and time spent on social networks in the regression. These results suggest changes in the brain reward system associated with increased, compulsive Internet use, consistent with past findings of altered connectivity in cortico-striatal circuitry. Thus, results support that compulsive Internet use, but not time on social networks, is driven by similar neural circuits as other addictive behaviors.

EFFECTS OF TMS OVER THE ANGULAR GYRUS DURING A SIMON TASK

Janine Jargow, Katharina Zwosta, Franziska Korb, Hannes Ruge & Uta Wolfensteller

Chair of General Psychology, Technische Universität Dresden, Germany

The angular gyrus (AG) was identified as one key player in learning and using stimulus-response-outcome contingencies and as part of a "bottom-up" attentional subsystem mediating the automatic allocation of attention to task-relevant information. In this pilot study we investigated the influence of right angular gyrus transcranial magnetic stimulation (TMS) on brain activation as measured by fMRI during a Simon Task to evaluate inhibitory and potential compensatory network changes and behavioral effects.

More specifically, 1Hz TMS was applied to 12 right- handed participants (4 male) for 20 Minutes in 2 sessions to rAG and vertex (control condition). Stimulation of each brain region was applied in random order to all participants. Shortly after stimulation the subjects underwent fMRI while performing a spatial Simon task, which creates a conflict due to the dimensional overlap between the irrelevant location of the stimuli and the response hand. Behavioral and brain activation data will be presented and discussed.

EATING JUNK FOOD VERSUS STAYING HEALTHY: TEMPORAL DYNAMICS OF SELF-CONTROL IN EVERYDAY CONFLICT SITUATIONS

Johanna Kruse[1], Franziska M. Korb[1], Uta Wolfensteller[1], Stefan Scherbaum[2] & Thomas Goschke[1]

[1] Chair of General Psychology, Technische Universität Dresden, Germany

[2] Chair of Methods of Psychology and Computational Modeling, Technische Universität Dresden, Germany

Self-control is typically defined as the ability to overcome current short-term impulses such as craving for junk food in order to achieve long-term goals such as staying healthy. Despite an increasing number of studies on self-control, little is known about the temporal dynamics of choice behavior in everyday self-control conflicts. Therefore, in the present pilot study we used mouse tracking to specifically trace the temporal dynamics of exerting self-control in everyday resist temptation conflicts (positive short-term but negative long-term consequences) and everyday endure aversion conflicts (negative short-term but positive long-term consequences).

Prior to the experiment, participants rated short- and long-term consequences of a set of everyday conflicts in an online survey. In the experiment, they used a computer mouse to indicate whether they would actually perform an action under certain circumstances or not. As a result, participants behaved in a self-controlled manner in 74% of the endure aversion conflicts, but failed to do so in 72% of resist temptation conflicts. Mouse movements revealed greater curvatures for self-control successes compared to failures in resist temptation conflicts and the opposite pattern for endure aversion conflicts. Different interpretations of these findings and further research steps are discussed.

POSTER SESSION II (Friday 13:30-14:30)

(8) Kührt, Corinna
Dispositional individual differences in effort investment: Exploring the core construct (B6)

(9) Möschl, Marcus
Effects of acute stress on prospective-memory monitoring and intention deactivation (A1)

(10) Müller, Dirk
Neuroimaging Center Python Pipelines: A web-based image processing framework (Z2)

(11) Schmidt, Kornelius
Comparability and stability of web-based response time assessment in domestic and laboratory settings (B5)

(12) Schwöbel, Sarah & Visconti, Cassandra
Active inference: Experimental and computational advances (Z2, A9)

(13) Seidl, Esther & Hilbert, Kevin
Piloting of cognitive control tasks for the project avoidance behavior as a result of one-sided exertion of cognitive control in specific phobia (C5)

(14) Senftleben, Ulrike
Validating the attractor dynamics approach to delay discounting (A8)

(15) Zink, Nicolas
Evidence for a neuronal dual-process account for adverse effects of cognitive control (B8)

DISPOSITIONAL INDIVIDUAL DIFFERENCES IN EFFORT INVESTMENT: EXPLORING THE CORE CONSTRUCT

Corinna Kührt[1], Florian Ott[2], Sebastian Pannasch[3], Stefan Kiebel[2] & Alexander Strobel[1]

[1] Chair of Differential and Personality Psychology, Technische Universität Dresden, Germany

[2] Chair of Neuroimaging, Technische Universität Dresden, Germany

[3] Chair of Engineering Psychology and Applied Cognitive Research, Technische Universität Dresden, Germany

Individuals dispositionally differ in their willingness to invest effort in obtaining their goals and in their tendency to show effort discounting. Indeed, self-reported Need for Cognition (NFC) and Self-Control (SC) correlate with behavioral measures of effort discounting or demand avoidance, respectively. Given that NFC and SC are moderately related, the question arises whether they share some common construct core being theoretically embedded within a broader model.

Thus, the present study aims at specifying a core construct of Effort Investment, i.e., for self-reported dispositional differences in the willingness and tendency to exert effortful control. We conducted an online-study (N = 613, 70% female, age mean ± SD: 29.1 ± 10.8 years) with several questionnaires related to cognitive motivation and effort-investment including the NFC and SC scales. We found substantial correlations between the assessed traits pointing to a core construct of Effort Investment. Furthermore, we could show that the relationship of NFC and SC is specifically mediated via an aspect that can be conceptualized as goal-directedness. Taken together, our results extend our current knowledge on traits related to Effort Investment and provide a basis for further research on the role of dispositional individual differences in goal-directed behavior.

EFFECTS OF ACUTE STRESS ON PROSPECTIVE-MEMORY MONITORING AND INTENTION DEACTIVATION

Marcus Möschl[1], Moritz Walser[1], Franziska Plessow[2,3], Thomas Goschke[1] & Rico Fischer[4]

[1] Chair of General Psychology, Technische Universität Dresden, Germany

[2] Neuroendocrine Unit, Massachusetts General Hospital, Boston, MA, USA

[3] Department of Medicine, Harvard Medical School, Boston, MA, USA

[4] Department of Psychology, University of Greifswald, Germany

In everyday life we frequently rely on our abilities to postpone intentions until later occasions (prospective memory; PM) and to deactivate completed intentions even in stressful situations. Yet, little is known about the effects of acute stress on these abilities. Here we investigated the impact of acute stress on PM functioning under high task demands. 1) We increased processing demands during intention deactivation. 2) We systematically manipulated PM-monitoring demands in a non-focal PM task that required participants to monitor for one or six syllables that could occur in ongoing-task words.

Replicating previous findings, stress induction (Trier Social Stress Test) did not affect PM performance and aftereffects of completed intentions during subsequent performance. Under high demands on intention deactivation, however, acute stress nominally increased erroneous PM responses after intention completion (commission errors). Most importantly, under high demands on PM monitoring, acute stress substantially reduced PM-monitoring costs. These findings support ideas of selective and demand-dependent effects of acute stress on cognitive functioning. Under high task demands, acute stress might induce a shift in processing strategy towards resource-saving behavior, which seems to increase the efficiency of PM performance (reduced monitoring costs), but might increase initial susceptibility to automatic response activation after intention completion.

NEUROIMAGING CENTER PYTHON PIPELINES: A WEB-BASED IMAGE PROCESSING FRAMEWORK

Dirk Müller, Lukas Reimer, Niklas Förster, Pascal Lehmann & Michael Marxen

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The NICePype (Neuroimaging Center Python Pipelines) image processing framework offers intuitive and efficient access to optimized pipelines through an easy-to-use web interface. It allows for an efficient configuration of complex processing pipelines without requiring in-depth knowledge of the algorithms. The details of the pipelines are available to the user in form of a short description for choosing the pipeline, a detailed description as needed for the method section of a publication, and a script containing the executed commands enabling the user to exactly reproduce the pipeline.

The core of the processing framework uses Nipype, an open-source neuroimaging data processing framework in Python. Therefore, we benefit from a big developer community and existing interfaces to various software packages (e.g., FSL, FreeSurfer, SPM). All pipelines run parallelized even in a heterogeneous computational environment, which greatly reduces processing time. Hash value checks are used to guarantee reproducibility of pipelines and results. Integrated quality assurance web tools are used for assessing motion correction, co-registration, and normalization. The web-interface and the underlying processing framework will be demonstrated at the summer school.

COMPARABILITY AND STABILITY OF WEB-BASED RESPONSE TIME ASSESS-MENT IN DOMESTIC AND LABORATORY SETTINGS

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Our modern world is difficult to imagine without the internet. However, web-based response time experiments are still rarely used in research practice. Although there are many promising findings regarding the quality of web-based data assessment common reservations hinder a comprehensive establishment. It was the aim of our study to examine to what extent web-based response time data collected under not standardized, domestic settings could lead to an undesirable increase of variability in comparison to data assessed in

We used three response time paradigms (i.e., Go/Nogo task, 2-Back task, Task Switch) programmed and presented by the Millisecond Inquisit software. Participants ran through the paradigms in two settings, i.e. at home and in the lab. Our data analyses show that for the majority of parameters there are no meaningful differences in data variability between settings. These results apply to all three paradigms and parameters of conventional aggregated data as well as diffusion modeling. However, some paradigms give hint to a susceptibility to flippancy in domestic settings. In sum, our results support a more extensive application of web-based response time experiments.

ACTIVE INFERENCE: EXPERIMENTAL AND COMPUTATIONAL ADVANCES

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The Bayesian brain theory offers a mechanistic explanation of specific aspects of cortical function: from motor function, the architecture of sensory processing, to decision making in pursuit of goals. Active Inference, as a framework that describes behavior within the Bayesian-brain theory, conceptualizes the strategy of prediction-error minimization as the result of a more underlying imperative to minimize free-energy. When free-energy is minimized, surprise is also minimized. The more free-energy (and consequently surprise) is minimized, the more an adaptive agent maximizes the evidence for a model of its incoming stimulus from the surrounding environment, and thereby improves inference of the underlying causes of sensory input. Recently, active Inference has also been successfully applied to decision-making experiments, as it describes precisely what an agent or human participant must compute when trying to reach a goal in a trial-based experiment: acting as best as possible with the currently available information.

Our current computational-experimental work focuses on how this framework enables us to explain goal-directed behavior in human subjects, by benchmarking their performance on decision-making tasks with the performance of an Active Inference agent. Furthermore, we aim to advance this framework by using different underlying mathematical models and approximations in the free energy formulation.

PILOTING OF COGNITIVE CONTROL TASKS FOR THE PROJECT AVOIDANCE BE-HAVIOR AS A RESULT OF ONE-SIDED EXERTION OF COGNITIVE CONTROL IN SPECIFIC PHOBIAS

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The C5-project investigates the role of cognitive control for avoidance behavior in phobia subjects. We investigate whether changes in cognitive control are limited to present feared stimuli. Therefore, modified neutral and phobogenic task-versions of established anticipation-discounting and goal-habit tasks were piloted. The current version of the goal-habit task was additionally piloted for MRI. Tasks were piloted in convenience samples. For anticipation-discounting (n_{total} = 38), the probability of choosing the more immediate reward was analyzed depending on pairing the immediate, less immediate or no reward with a phobic or neutral stimulus. For goal-habit (n_{total} = 14), accuracies and reaction times were analyzed for responses either compatible or incompatible to previously learned or without previously learned habits. During the anticipation-discounting task, subjects more likely chose the reward accompanied by any stimulus in both stimulus sets. For the goal-habit task, results showed significant habit effects for accuracies and trend-level habit effects for reaction times in goal-directed trials. Established task effects were present after modification and use in MRI.

The increased likelihood of selecting the reward paired with either kind of stimulus irrespective of the condition points towards an effect of attention in anticipation-discounting. Modified tasks thus can be used for the main study.

VALIDATING THE ATTRACTOR DYNAMICS APPROACH TO DELAY DISCOUNTING

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When choosing between a small but immediate and a large but delayed reward, people discount rewards by their delay. The outcomes of such decisions are well described by discounting functions. However, in order to understand such delay discounting behavior it is necessary to look beyond decision outcomes and unfold the dynamics of the decision making process. Here, we validate a recently published attractor model that describes the within- and inter-trial dynamics of delay discounting decision-making.

In this study, we focus on inter-trial dynamics. Hence, we derive hypotheses of the inter-trial dynamics of sequences of decisions that are unique to this type of model. We test the model's predictions about decision inertia and modulators in three experiments based on a dynamic delay discounting computer game where we sequentially manipulate the subjective value of reward options. Our results confirm the model's predictions and thus provide support for the validity of the attractor model of delay discounting.

EVIDENCE FOR A NEURONAL DUAL-PROCESS ACCOUNT FOR ADVERSE EFFECTS OF COGNITIVE CONTROL

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Advantageous effects of cognitive control are well-known, but cognitive control may also have adverse effects, for example when it suppresses the implicit processing of S-R bindings which could benefit task performance. Yet, the neural mechanisms underlying such detrimental aspects of cognitive control are still poorly understood, partly because these processes are subject to large inter-individual variation. For this, we compared individuals who exhibit adverse effects of cognitive control to individuals who do not by combining event-related potentials (ERPs), source localization, time-frequency analysis and network analysis methods.

The results show that differences in the degree of adverse effects can be explained by two independent neural mechanisms that have dissociable neurophysiological and functional neuroanatomical underpinnings: The first factor is a control mechanism, which is reflected by modulations of the network architecture of theta frequency oscillations and sensitive to the composition of both S-R bindings and level of cognitive control demands. The second is an updating mechanism, which is reflected by the P3 ERP component and associated with the TPJ (BA 40). The findings show that implicit S-R contingencies that benefit response selection without cognitive control are always 'picked up', but may fail to be integrated with task representations to guide response selection.

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